PROJECT 5 OVERVIEW

Developing Common Data on Accident Circumstances

BACKGROUND

Over time, each transportation mode has developed its own way of describing the circumstances surrounding crashes and mishaps. Consequently, there is little consistency across modes in how data are collected and in the characteristics of data describing a mishap. Efforts to define important factors that may contribute to crashes/mishaps are often limited to a single factor or to a poorly delineated group of factors such as “operator error." A more detailed characterization of human factors and crash survival factors is needed in most transportation modes.

Objective

The objective of Project 5 was to describe the type of data currently available, compare it with that needed by investigators and researchers in order to identify the factors and circumstances that are present in transportation crashes and incidents, and make recommendations for improved data. A major aim was identification of those data elements needed for application of a common conceptual framework of event factors across a wide variety of events and modes.

GENERAL APPROACH

- Identify a conceptual framework of crash/incident factors for use across transportation modes.
- Identify types of information collected on crash/incident factors for the various modes.
- Identify methods for categorization/coding of crash/incident factors by mode.
- Determine how crash/incident factor information is collected by mode.
- Identify limitations of current crash/incident factor categorizations by mode.
- Make recommendations for improvement.

Scope

This project identifies typical crash and incident factors for various modes used during investigations. Included are all transportation crashes or mishaps, defined as:

- any incident involving the movement or operation of a vehicle, vessel, aircraft, pipeline, or other conveyance in the course of conveying persons or goods from one place to another;
- occurring within U.S. jurisdiction or involves a U.S. commercial carrier;
- intentional or unintentional; and
- resulting in substantial property damage or injury (requiring medical attention beyond first aid) or death within 30 days of passengers, crew, pedestrians, other workers, or bystanders.

Data Sources

The data reviewed for this project were collected by U.S. Department of Transportation (DOT) agencies, other federal agencies, and nonfederal agencies such as state medical examiner offices.

CONCEPTUAL FRAMEWORK

We identified the Haddon Matrix as the ideal framework, because of its combination of simplicity and comprehensiveness. The 12-cell Haddon Matrix is the conceptual framework or model most widely used in the injury prevention field and is commonly used to analyze risk factors or prevention measures for mishaps and injuries. The matrix divides the injury event into three phases: "pre-event" (contributing to the likelihood that a crash or other potentially injurious or damaging event will occur); "event" (influencing the likelihood and severity of injury when a crash, fall, etc., occurs); and "post-event" (influencing the likelihood of survival or complete recovery).

Each of the three phases is further divided into four groups of risk factors: those related to 1) the operator or the person who may be injured, 2) the vector or vehicle that transmits the energy, 3) the physical environment, and 4) the social/cultural/organizational environment.

Advantages of the Haddon Matrix are that it is relevant to all transportation modes, is well known and widely applied in the injury field, and can be expanded to accommodate various taxonomies. It can be used to organize risk factors, exposure, circumstances of injury, and preventive measures.

Other analytical or conceptual frameworks such as SHEL and Event Tree Analysis were considered but are generally less comprehensive than the Haddon Matrix, although they may provide more details on one or more cells in the Haddon Matrix.

CRASH/INCIDENT DATA ELEMENTS

The primary databases for each mode should contain information on factors that contribute to the likelihood of a mishap or the occurrence and severity of injury and are structured in a multistage matrix covering pre-event, event, and post-event factors for the following**:** human factors, vehicle factors, physical environment factors, and social/organizational factors.

MAJOR GAPS AND LIMITATIONS IN DATA

- The quality of data is often less than optimal.
- Some important data elements are rarely collected, such as data on the injury mechanism, whether the person was at work, operator fatigue, and distractions; alcohol data are not routinely collected for all appropriate people.
- Lack of information on injury type and severity (except in NHTSA's NASS/CDS), for example, on surviving airplane passengers.
- Lack of information on uninjured passengers in some state police reports.
- Lack of narrative description, or lack of use of the information in narratives.
- Lack of detail on human factors.
- Lack of feedback to investigators.
- Absence of guidelines for law enforcement officers and others on whom we rely to provide data on transportation incidents.

- Some transportation events such as those involving off-road vehicles, suicide, terrorism and injuries that occur in the absence of a collision are typically not recorded by police or by a DOT agency.
- Linkage of crash investigation reports with death certificate and autopsy data is typically absent.

RECOMMENDATIONS

Data Quality, Adequacy, and Completeness

Changes should be implemented in all transportation systems to ensure that crucial data elements, as outlined in the full report, are included. In addition, the Bureau of Transportation Statistics should work closely with those states having good medical examiner systems to establish procedures for testing and for electronic reporting of all transportation deaths, including pedestrians and passengers.

Improved Methodology

The following recommendations may provide more and perhaps better data. Greater use can be made of sampling to obtain more detailed information on events of interest. Supplemental studies can be used in connection with sampling. For example, at various times data could be collected on all events involving certain types of vehicles or specific circumstances. Confidential reporting systems, similar to ASRS (NASA's Aviation Safety Reporting System) for aviation incidents, could be developed and used by other modes. Special studies using other national databases such as CPSC's National Electronic Injury Surveillance System (NEISS) could be used to address those transportation-related injuries for which data are not routinely collected by DOT agencies. Finally, high-quality data from states or counties should be combined to provide more complete national estimates.

Improvements in Data to be Collected or Reported

Details about crash severity and mechanisms of injury are needed, especially for general aviation crashes. Systematic samples of crashes, as is currently done for automotive injuries through NASS/CDS, would be a good place to start.

Photographic evidence should be added to files in a format available to and usable by researchers.

All forms for reporting injuries and events should include narrative text on incident circumstances, which would need to be entered and analyzed.

The National Household Travel Survey (NHTS) should include information (e.g., age, gender) on nonfamily passengers.

Greater use should be made of GIS (geographic information systems) to identify exactly where crashes occur and to relate location to highway, seaway, rail, or other features.

To the extent feasible and productive, data elements should be made comparable across modes and among agencies.

Available data from non-DOT sources should be incorporated into DOT data records (e.g., race and occupation are available on the death certificate and should be added to DOT data on fatally injured operators or other persons).

For a sample of fatal crashes, it would be valuable to have linked crash investigation reports and autopsy data.

Greater Use of Technology to Improve Data

A variety of technologies could advance data-collection efforts:

- Incorporation of Event Data Recorder (EDR) data into police reports and FARS and NASS data, in a manner easy for researchers to use, should be an objective.

- Installation of Automatic Crash Notification (ACN) in all road vehicles should be encouraged and the data included in reports of investigators.

- Drop-down menus for data entry by crash investigators have promise; for example, crash investigators could use hand-held devices for entering information as they investigate a crash.

- As other technologies to obtain data (e.g., cameras, GPS/GIS, alerting devices) become available and reasonable in cost, they should be used and the data from them incorporated into incident/crash reports.
- Evaluations are needed to determine whether currently available automatic warning systems are working as intended. An example of this technology is radar, employed in trucks, that emits warning sounds if the vehicle is too close to an object.

Other Recommendations

In order to identify new problems in a timely fashion, data should be made available at least on a quarterly basis.

Easier access to data from the National Driver Registry, currently not available to researchers, would be desirable.

Greater use should be made of some databases such as ASRS.

Increased frequency of surveys that collect data that may change substantially each year would be helpful, e.g., Nationwide Personal Transportation Survey and Vehicle Inventory and Use Survey.

BTS should routinely obtain DOT-relevant data that are not contained in DOT databases (e.g., bicyclist injury data should be obtained from CPSC, since most do not involve motor vehicles and/or public roads and therefore are not included in police reports).

Creation of an office within BTS/DOT to assist external researchers with projects that require use of various DOT-sponsored data systems is especially important for projects requiring linked information from different data systems about individual cases.

Provision of data on the Internet would be helpful, such as data from FARS, GES, NTSB, NPTS; results of periodic DOT surveys such as the National Survey of Drinking and Driving Attitudes and Behavior; and where to find relevant data, both DOT and non-DOT.

DETAILED RESEARCH PROTOCOLS

Full proposals were developed for the following research suggestions, considered by Project 5 members to be the most important:

- Sampling System for Collecting Detailed Data on Aviation Crashes;

- Use of Narrative Text Mining to Supplant/Validate Fixed Field Responses of Naïve Coders;

- Human Factors Taxonomy, Event Data Recorders, and Transportation Safety; and

- Using Indexing Systems to Identify Precursors of Vehicle Crashes, Injuries, and Deaths (this proposal is especially relevant to Project 6).

CONCLUSIONS

The Department of Transportation's mandate includes the safety of the traveling public. Underlying the identification of transportation risks and potential remedies is the need for adequate data.

DOT's Bureau of Transportation Statistics has an opportunity to improve safety through enhancements to the data collected by the various federal agencies. This report highlights many of the gaps and limitations in transportation data and recommends specific improvements.

Some data gaps and differences among various federal agencies reflect restrictions on legislative authority stipulated in the *Code of Federal Regulations*. Consequently, legislation must be passed to eliminate these gaps, a process that must be championed by each agency. Members of the Safety Data Action Plan were instructed to disregard the existence of legislative barriers when considering data problems and needed improvements.

Regardless of possible barriers to implementation of some aspects of the recommendations, we believe that major steps can and should be made to improve transportation data. Existing databases of the various modal agencies reflect interest in and commitment to useful data collection. We are therefore optimistic that this report will bear fruit.